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forwarded, it is related that the star progressed steadily till the moment when it was just wholly within the lunar edge, and then vanished instantaneously. Mr. Lassell remarks, that a star being an indivisible point, and its apparent disk spurious, we might expect to see one-half of the disk thus overlapping the moon's, and that the perplexity felt in seeking an explanation attaches rather to the outer half-disk.

The Astronomer Royal, regarding the reality of the phenomenon as thoroughly established by the concurrent testimony of many able observers, calls attention to the circumstance of its being most frequently and strikingly exhibited in the case of *Aldebaran* and the red stars. He suggests that all occultations of *Aldebaran* should be carefully tabulated, with accounts of the circumstances of the observations, and divided into two classes, one in which the star was situated above the centre of the moon, and the other in which it was below, and that the difference of refraction of the white and red rays should be well weighed as a possible contributing cause.

On Optical Phenomena in Occultations. By the Rev. Baden Powell, M.A., F.R.S., F.R.A.S., Savilian Professor of Geometry in the University of Oxford.

"The singular optical appearances so often witnessed in occultations and allied phenomena, have been ascribed (as is well known) to several causes, (1.) instrumental, or properly optical; (2.) ocular, or personal; (3.) atmospheric, whether lunar, planetary, or terrestrial; or to some combinations of these.

"So far as causes *properly optical* are concerned, I have examined the recorded observations in all the recent cases, with a view to obtain, if possible, some data, especially as referring to the hypothesis of 'irradiation,' or 'diffraction of the object-glass.' In this case, as I have pointed out in a paper in the *Memoirs* of this Society,[1] the essential element *in theory* is the *ratio of the aperture to the focal length* of the telescope employed; the diffraction increasing with the *relative* diminution of the aperture; though, *cæteris paribus*, the effect will be increased by greater *absolute* aperture (*i. e.* more light), and diminished by higher power, *i. e.* diminished intensity of light.

"As on a former parallel occasion,[2] so in reference to recent instances, I have collected, in the annexed tabular view, the data belonging to the several instruments employed; which have been in many instances kindly furnished by the respective observers, beyond the particulars given in the *Notices*.

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[1] Astronomical Society's *Memoirs*, Vol. xviii. p. 69.

[2] Astronomical Society's *Memoirs*, Vol. xxi. pt. I. p. 116.

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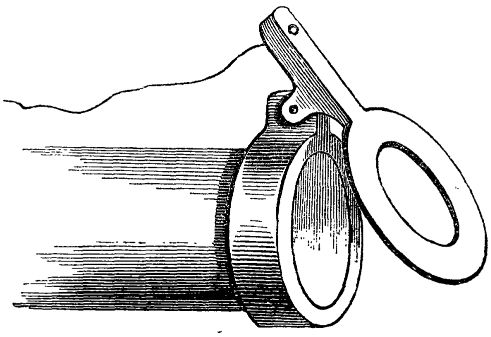
"The several cases are arranged in the order of the magnitudes of the *ratio of aperture to focal length*.

"Under the head of 'Phenomena' I have merely designated in the briefest terms possible those appearances described, which seem likely to have any optical relations; presuming the accounts in the *Notices* to be known to the reader. I may add that Mr. Peto, in a letter to me, speaks of the projection which he witnessed as of the limb of *Jupiter indenting* that of the moon, and marked by the dark border observed in so many other cases. He gives a sketch, which seems exactly to agree with the appearance noticed by Professor Challis, which he ascribes to the emergence taking place at a part of the moon's limb where there was a depression. This description might consist with a projection as supposed by Mr. Peto.

"The peculiar halo of light after the disappearance of the satellite noticed by Mr. Brodie, and also, as he informs me, by a friend using the telescope formerly Dr. Pearson's,—as well as the light appearing on the moon at, or after, the immersion of the planet, noticed by several observers—though ascribed by some to a lunar atmosphere—seem to me phenomena apparently allied to those I have formerly adverted to,[1] occasioned by a divergence of light.

"For instantaneously applying or removing a contracted aperture to or from the object-glass, I have found very effective the simple contrivance represented in the annexed sketch, which requires no description, and is effected by merely pulling the string. Several diaphragms with different apertures might be applied over each other in the same way. I made a rough trial of this method in the late occultation, making several alternations during the immersion: but saw no change. Perhaps, however, the loss of light was too great.



Occultation of Jupiter by the Moon, January 2, 1857.

(*See Astronomical Society's Notices*, vol. xvii. No. 3.)

Observer.	Focal Length = F.	Aperture = A.	Ratio $\frac{A}{F}$	Power.	Phenomena.
	ft. in.	in.			
Baxendell (Newtonian)	9 0	13·0	$\frac{1}{8\cdot3}$	...	Imm., light on ♃.
Hippisley (Newtonian)	7 4	9·25	$\frac{1}{9\cdot4}$	60	Imm., flattening of ♃. Em., dark shade.
Criswick (Greenwich, W. Equat^{l}.)	3 0	3·6	$\frac{1}{10}$	...	Em., projection of ♃'s limb.

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[1] Astronomical Society's *Memoirs*, Vol. xvi. p. 301.

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Observer.	Focal Length = F.		Aperture = A.	Ratio $\frac{A}{F}$	Power.	Phenomena.
	ft.	in.	in.			
Glaisher (Greenwich, 30-in. Achr.)	2	6	2·7	$\frac{1}{11\cdot1}$	...	None.
Huggins	5	0	5·0	$\frac{1}{12}$	50	None.
Lassell (Newtonian)	20	0	20·0 (reduced)	$\frac{1}{12}$	316	Imm., distortion of ♃; Em., dark shade.
Lowndes (Adm^{l} Smyth's Equatoreal)	8	6	5·9	$\frac{1}{12\cdot1}$	240	Imm., distortion of ♃.
Dawes (Alvan Clark)	10	0	8·0	$\frac{1}{12\cdot5}$	160	Imm., light on dark limb of ☽.
Ellis (Greenwich, 46-in. Achr.)	3	10	3·6	$\frac{1}{13}$	170	None.
Simms (1)	2	6	2·25	$\frac{1}{13\cdot3}$	...	Em., dark shade.
Grove (Binocular)	4	3	3·37	$\frac{1}{13\cdot4}$	60	None, though looked for.
Watson (Newtonian)	9	0	8·0	$\frac{1}{13\cdot5}$	100	None.
Mann	4	0	3·5	$\frac{1}{13\cdot6}$	120	Em., ♃ preceded by patch of light on moon (projection?) Dark shade.
Simms (2)	6	4	5·5	$\frac{1}{13\cdot8}$	...	Em., dark shade.
Lord Wrottesley	10	9	7·75	$\frac{1}{14\cdot1}$	140	Imm., light on dark limb of ☽.
Main (Greenwich, S. Equat^{l}.)	8	2	6·7	$\frac{1}{14\cdot6}$	...	Imm., distortion of limb of ♃; bright band on ♃; repetition of disappearance.
Brodie (1)	9	5	7·45	$\frac{1}{15\cdot1}$	106	Imm., projection of sat.; light outside limb of ☽ after disappearance.
Webb	5	6	3·7	$\frac{1}{15\cdot2}$	144	Imm., light on limb of ☽ after disappearance. Em., dark shade.
Burr	4	4	3·38	$\frac{1}{15\cdot4}$	173	Imm., light on limb of ☽.
Peto	5	0	3·875	$\frac{1}{15\cdot4}$	120	Em., projection of ♃, with dark shade (*qy.* same as Challis?)
Dunkin (Greenwich, N. Equat^{l}.)	5	4	4·1	$\frac{1}{15\cdot8}$	...	Imm., light on dark limb of ☽.
Lynn (Greenwich, Altazimuth.)	5	0	3·75	$\frac{1}{16}$	...	None.

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Observer.	Focal Length = F. ft.	in.	Aperture = A. in.	Ratio $\frac{A}{F}$	Power.	Phenomena.
Hodgson	8	0	6·0	$\frac{1}{16}$	160	None.
Pogson	10?		7·2	$\frac{1}{16{\cdot}7}$	93	None.
Johnson (Heliometer)	10	5	7·5	$\frac{1}{16{\cdot}8}$	150	None.
Hartnup	12	0	8·5	$\frac{1}{16{\cdot}9}$	134	Em., projection of sat.
Simms (3)	22	0	15·0	$\frac{1}{17{\cdot}6}$	200	Imm., distortion of ♃.
Slatter	7	4	4·9	$\frac{1}{17{\cdot}9}$	87	Em., sat. adhered, and suddenly separated.
Simms (4)	22	0	13·0	$\frac{1}{20{\cdot}3}$	200	Em., dark shade.
Challis (Northumberl^{d})	19	6	11·5	$\frac{1}{20{\cdot}3}$	215	Em., ♃ as if in a hollow of ☽; dark shade (*qy.* projection ?)
Brodie (2) a friend, (Dr. Pearson's)	12	0	6·8	$\frac{1}{21}$	...	Same as Brodie (1).

Occultation of Jupiter by the Moon, November 8, 1856.

(*Astronomical Society's Notices*, vol. xvii. No. 1.)

Observer.	Focal Length = F. ft.	in.	Aperture = A. in.	Ratio $\frac{A}{F}$	Power.	Phenomena.
De La Rue (1) (Newtonian)	9	11½	13·0	$\frac{1}{9{\cdot}2}$	...	None.
Huggins	5	0	5·0	$\frac{1}{12}$	176 (corrected)	♃ grazed ☽.
Grove	1	10	1·75	$\frac{1}{12{\cdot}5}$	43	Imm., junction of limbs; dark shade.
De La Rue (2) (Achrom.)	3	0	2·5	$\frac{1}{14{\cdot}4}$	...	None.
Burr	4	4	3·38	$\frac{1}{15{\cdot}4}$	...	Imm., ♃ grazed ☽; dark shade.
(also Jan. 2d) Goddard	6	2	4·125	$\frac{1}{17{\cdot}9}$	200	Imm., adhesion; dark shade.

Eclipse of Jupiter's First Satellite, January 3, 1857.

Observer.	Focal Length = F. ft.	Aperture = A. in.	Ratio $\frac{A}{F}$	Power.	Phenomenon.
Hodgson	8	6	$\frac{1}{16{\cdot}0}$	140	Projection of sat. on ♃.

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Occultation of Jupiter by the Moon, August 19, 1856 (*Canada*).

(*Astronomical Society's Notices*, vol. xii. p. 221.)

Observer.	Focal Length = F. ft in.	Aperture = A. in.	Ratio $\frac{A}{F}$	Power.	Phenomenon.
Chalmers	3 16	2·75	$\frac{1}{14\cdot4}$	60	Apparent repulsion of contact.

"From this tabular view it appears that all the cases of projection (or what appear such),—or others which may be conceived due to similar optical causes,—occur with telescopes having ratios between $\frac{1}{13}$ and $\frac{1}{20}$; with the single exception of that of Mr. Criswick, with a ratio of only $\frac{1}{10}$. Yet that gentleman's description of the phenomenon is graphically what ought to be the optical effect due to enlargement of the disk.

"We have as yet no data for assigning the limits of this telescopic ratio for producing enlargement of disks; but generally in this instance they do not appear to follow any perceptible relation to the size or perfection of the instruments. We must still suppose them in a great degree due to *ocular* causes as yet little understood."

Abstract of a Paper "On the Horary Variation of Meteors."

By G. C. Bompas, Esq.

(*Communicated by Professor De Morgan.*)

The fact of a *horary* variation in the number of shooting stars observed has been established by the researches of Coulvier Gravier, Saigey, and others.—(*Recherches sur les Etoiles Filantes*, Paris, 1845; and Humboldt *Cosmos*, iii. 440.)

The following table contains a summary of these results:—

Hours, P.M.	6 to 7	7 to 8	8 to 9	9 to 10	10 to 11	11 to 12
Mean No. of Meteors.	3·3	3·5	3·7	4	4·5	5

Hours, A.M.	12 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6
Mean No. of Meteors.	5·8	6·4	7·1	7·8	8	8·2

Thus it appears that the minimum occurs at 6 P.M.; the mean at midnight; and the maximum at 6 A.M.; and that two-thirds of the whole number appear between midnight and 6 A.M.

If we designate the number coming from N, S, E, and W, by those initials respectively, then $E > 2W$, $N = S$ nearly, but $E + W = N + S$.